

REMARKS

Claims 1-20 are now in the application. By this Amendment, claims 1, 3, 4, 9, and 12-14 have been amended to comply with formal requirements but not to limit the claim scope. In addition, claim 1 is amended to recite “by removal” instead of “comprising” to correct a mistakenly included amendment in the Preliminary Amendment filed on May 9, 2006. Support for this amendment is found at least at original claim 1. Further, the specification and the abstract have been amended. No new matter has been added.

The Office Action objects to the Abstract because it contains more than 150 words. The Abstract is replaced by the enclosed Substitute Abstract containing 146 words set forth on page 3 of this response. Accordingly, the Abstract complies with formal requirements.

The Specification is objected to because it does not contain a section header “Brief Description of the Drawings.” The Specification has been amended as suggested in the Office Action. Further, the Office Action objects to the Title and the Abstract because the Specification allegedly does not teach the removal of the acid gases from a liquid stream. The Title and the Abstract are amended as suggested in the Office Action. However, the Office Action mischaracterizes Applicants’ disclosure by asserting that the Specification only contemplates the removal of acid gases from gases, such as natural gas, which are not liquids. Applicants note that the acid gases are temporarily absorbed in a liquid absorption medium, i.e., a liquid, from which they are subsequently removed. Accordingly, the Title and the Abstract properly state that acid gases are removed from a fluid and are not limited to the removal of acid gases from another gas.

Claim 1 is objected to because the feature “liquid” in line 2 should allegedly be amended to recite a “fluid.” Claim 1 has been amended as suggested in the Office Action. Claim 9 has been objected to because the features “H₂S” in the third line is allegedly redundant. Claim 9 has been amended as suggested in the Office Action.

Claims 1, 3, 4, and 12-14 have been rejected under 35 U.S.C. §112, second paragraph, for allegedly being indefinite. Specifically, the Office Action asserts that the feature “if appropriate” recited in claims 1, 3 and 12 and the feature “principally” recited in claims 3 and 12 are

indefinite. Claims 1, 3 and 12 have been amended to obviate this rejection. Further, claims 3, 13, and 14 have been rejected because the recitation of the species “acetylmorpholine” and “N-formlymorpholine” in parentheses after the genus “aliphatic acid amines” allegedly renders these claims indefinite. Claims 3, 13, and 14 have been amended to obviate this rejection.

Claims 1-20 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. 4,853,012 to Batteux et al. in view of U.S. 4,336,233 to Appl. et al. and further in view of U.S. 5,562,891 to Spencer et al.

Claim 1 recites, among other features, the molar fraction of H₂S, based on the total amount of acid gases, being at least 50 mol%. At least this feature cannot reasonably be considered to have been suggested in Batteux et al.

Batteux et al. suggests, at col. 8, lines 33-35, a natural gas consisting mostly of methane, and containing, by volume, 0.5% H₂S and 5% CO₂. Thus, Batteux et al. suggests a natural gas in which the amount of H₂S, based on the total amount of acid gases, is less than 10 % by volume, which is approximately 10 mol%.

Further, Batteux et al. suggests a process for deacidification of a gas containing mercaptans and other acid gases, namely H₂S and/or CO₂, that removes not only H₂S and CO₂, but also a sufficient amount of mercaptans (col. 2, lines 3-9). This object is achieved by the process described in col. 2, lines 12-45 of Batteux et al., which includes the presence of a second absorption zone for absorbing mercaptans not already absorbed in the first absorption zone. The mercaptan laden absorbent leaving the second absorption zone is, after reduction in pressure, regenerated in a separate regeneration zone and recycled. As set forth at col. 3, lines 53-56, of Batteux et al., the acid gas is preferably released against a pressure of 1.3 to 2.5 bar.

By contrast, as set forth at page 3, lines 12-15 of Applicants’ disclosure, Applicants claim a method for providing an economical process in which acid gases comprising at least 50 mol% H₂S are removed from a fluid stream and to provide the acid-gas stream at a high pressure. Batteux et al. fails to suggest any starting point for achieving the stated object since Batteux et al.

suggests the removal of mercaptans via a two-stage absorption and regeneration process, but fails to suggest recovering pressurized acid gas.

Further, one of ordinary skill in the art would have expected that the regeneration of a laden absorbent to be very energy-consuming because significant heating should be required owing to the elevated pressure.

However, Applicants discovered that specifically those fluid streams comprising as impurities H₂S and optionally other acid gases, the molar fraction of H₂S, based on the total amount of acid gases, being at least 50 mol%, require less energy to regenerate with increasing pressure in the regeneration stage than, for example, at a pressure of 2.5 bar, as evidenced by Fig. 2. Specifically, case 1 in Fig. 2 depicts the relative reboiler duty for each pressure for an acid gas having a CO₂/H₂S ratio of 0.36, which corresponds to a relative H₂S content of approximately 73.5% compared to the total amount of acid gas. Starting at a pressure of approximately 3 bar, the relative reboiler duty decreases with increasing pressure. At a pressure of about 20 bar, the relative reboiler duty is approximately back to the 100% relative reboiler duty level of a regeneration at 2 bar pressure.

By contrast, case 2 depicted in Fig. 2 has a CO₂/H₂S ratio of 2.75, which corresponds to a relative H₂S content of approximately 26.7% compared to the total amount of acid gas. In this case, the relative reboiler duty more than doubles with an increasing pressure from about 2 bar to about 3.5 bar and remains at a constant high level with further increasing pressure, although a continuous decrease can be observed here as well.

Thus, the claimed subject matter is directed to regenerating an acid-gas laden absorbent in a pressure range from 3 to 30 bar, which provides an extremely energy-efficient process capable of deacidifying gas streams wherein the molar fraction of H₂S, based on the total amount of acid gases, is at least 50 mol%, and yet, at the same time also recovers the acid gas at a relatively high pressure. Therefore, is generally possible, for example, to force the acid gas into subterranean deposits or water layers without further energy-intensive compression. Such a process is not suggested in Batteux et al.

The Office Action relies on Appl et al. for suggesting an absorption solution comprising piperazine and on Spencer et al. for suggesting storage of carbon dioxide in the ocean. However, Appl et al. and Spencer et al. are not applied in a manner to cure the deficiencies of Batteux et al. as discussed above.

Claims 2-20 depend, directly or indirectly, from independent claim 1. Claims 2-20 are in condition for allowance for at least their dependence on an allowable claim 1, as well as for the additional patentable features that these claims recite.

In view of the above, Applicants believe the pending application is in condition for allowance.

In the event the Examiner believes an interview may help in any way to further the prosecution of this application, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Applicants believe no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 03-2775, under Order No. 12810-00248-US1 from which the undersigned is authorized to draw.

Dated: August 21, 2008

Respectfully submitted,

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